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EDITORIAL.—LEERS, the German botanist, to whom the genus *Leersia* was dedicated, accidentally receives from the types of the GAZETTE a treatment almost as rough as the sheaths of his gramineous namesake. His name was printed "Leen" on page 140, and the endeavor to correct it on page 53 produced "Leer's."

IN THE NOTICE OF DR. ENGELMANN'S admirable *Revision of the Genus Pinus*, we inadvertently stated that only forty-five of the species—those upon which notes are appended—had been examined by himself. An inexcusable error; for the author distinctly declares, on page 15, that he had examined every species in his enumeration.

IN MR. T. J. HOWELL'S advertisement of Oregon plants in the last GAZETTE, it was stated that he would botanize in Wyoming Territory during the coming season. It should have read Washington Territory, a correction which we hope will be noticed by all desiring to purchase western plants.

MR. A. H. CURTISS is preparing for a tour of the Florida Reefs, and afterwards expects to go into the interior of the State. We may expect some rich results.

THE DEATH OF MR. COE F. AUSTIN should have been noticed before in the GAZETTE. The announcement came with a shock to those who were only acquainted with Mr. Austin through correspondence. The GAZETTE was indebted to him for many valuable notes on Mosses and Liverworts, and such seemed to be the vigor of his intellect, the quickness of his observation, that they were by no means associated in our minds with a feeble body and failing health. He died at the age of 48, at his birthplace, Closter, N. J. His widow has put on sale his valuable collections of Musci and Hepaticæ, and it is to be hoped that botanists will promptly procure sets, "both for their own sakes and the sake of the family of this devoted scientific worker." The prices are as follows: Musci Appalachiani, $25; supplement to Musci, $6; Hepaticæ Boreali Americanæ, $15.

IN THE SAME CONNECTION we would mention the death of John Carey. He died at Blackheath, near London, March 26 ult., in the 83d year of his age. Mr. Carey contributed the articles on *Salix* and on *Carex* to the first edition of Gray's Manual.

AT NEARLY THE SAME DATE, another eminent botanist died at Paris, Wm. Ph. Schimper, whose name is so familiar to bryological students. He was in his 73d year. Twenty years of his life were devoted to the publication of what is called "a grand scientific monument," the *Bryologia Europæa*. "This contains in six quarto volumes a detailed description of all the species of Mosses known in Europe, each illustrated by a full plate of figures, beautifully and exactly re-

producing the characters of the divers parts of the plants and of their variations." Prof. Schimper's later years were devoted to the study of vegetable paleontology.

THE BOTANIC GARDEN at Cambridge is no longer a local, but a national concern. The eyes and thoughts of the botanists of this country are directed to it as naturally as are those of English, in fact the world's, botanists, to the Kew Gardens. There we find the largest herbarium, the largest library, the largest collection of living plants, indigenous to our own country, to be found anywhere on the continent. But still we can have more. and what is more to the point, we are going to have it. The present director, Prof. George L. Goodale, is a man of indomitable energy, and his heart is in this work of developing the Garden. He can keep more irons in the fire at once, and have them all hot, than any gentleman of our acquaintance. Of course improvement means money, and money is what botanists are not generally blessed with, and hence we will not make a financial appeal to them, although about $80,000 would be very acceptable. But botanists, more than any other persons, know good plants and where they can be procured, and if the botanists of this country would make it a point to send good living roots or seeds of their local rarities to Cambridge, they would be doing themselves very little inconvenience, and might do the Garden great good. The best plan would be to send to the Director a list of rare plants whose roots or seeds can be procured by the writer, and then all needless trouble would be avoided. Mr. Sereno Watson has in charge the naming of the large collection already under cultivation, and his name is a guarantee to botanists that all the labels can be depended upon.

VITALITY OF THE SEEDS OF SEROTINOUS CONES.—On page 54 Prof. Sargent gave the results of his experiments with serotinous (closed) cones of *Pinus contorta*, which I had collected in 1874 in Colorado, kept for more than four years in a garret, and sent to him in the spring of 1879. Seeds of cones 13 years old and 10 years old did not germinate; one out of six of 9 year old seeds, one out of eleven of 8 year old seeds, one out of three of 7 year old and one out of four of 6 year old seeds germinated and grew up well; those of 5 year old cones did not come up. Prof. Sargent pronounces the result to be unsatisfactory. To me it seems to be eminently satisfactory. It proved that part of the seeds from cones 5 to 9 years old had retained their vitality and that those that are older than 9 years failed; younger ones would undoubtedly have also germinated had such been experimented upon. The result shows that pine seeds of serotinous cones, or, to be more exact, seeds of *Pinus contorta*, kept under the circumstances detailed above, could and did retain their vitality a number of years—even nine years—while the perishable nature of pine seeds under ordinary circumstances is well known. The economy or the effect of keeping the cones closed is therefore evidently the preservation of the vitality of the seeds for a number of years beyond their maturity. What is not fully known and what will have to

be investigated, is how and when such seeds of serotinous cones are eventually liberated and made available, and whether not a great many of them at last perish, the cones never opening.—G. ENGELMANN.

FRAXINUS QUADRANGULATA has, at least about Allenton, in St. Louis county, Missouri, hermaphrodite flowers. Mr. G. W. Letterman finds it there common on rocky hills where it is a small tree or shrub with blunt angles of the branchlets, and in rich bottom lands, where the tree is large, and the angles of the branchlets sharp and even winged. Leaves are sometimes in threes when the branchlets show six angles. The terminal buds are gray-downy. In both localities the flowers are hermaphrodite. The calyx is practically absent, or indicated only by two obscure knobs or two minute scales, alternating with the stamens; the anthers are sessile and (before opening) reniform, their two cells being united above; stamens somewhat persistent at least to the beginning of May, when the young obovate-oblong fruits, already somewhat twisted (which twist is more marked in the mature fruit), have reached about half their full size. How does the species behave in other parts of the country? The style of *Fraxinus Americana* is very slender—much longer than the ovary; that of *F. viridis* does not much exceed the ovary.—G. ENGELMANN.

NOTULÆ EXIGUÆ.—THREE-FLOWERED BLOODROOT.—Among the anomalies occasionally met with, the most unexpected is a scape of *Sanguinaria Canadensis*, found by Mr. E. N. Wheeler, in the vicinity of Boston, bearing a pair of opposite bracts about half an inch below the terminal flower, each bract with a well-formed flower in its axil!

TRILLIUM SESSILE, as we learn from Mr. Lehman, of Salem, North Carolina, and from a specimen sent by him, abundantly occurs in the neighborhood of Kingston, Tenn., with bright yellow petals; and I have recently heard of this form from other western sources. Specimens, and especially living roots, taken up in autumn, are desired.

PERULARIA VIRESCENS is the proper name for *Habenaria* (*Perularia*) *virescens* of Gray's Manual. The examination of fresh specimens shows the "*cuculli bivalves*" of Lindley, the two lips of the base of the anther-cell which fairly cover the gland. In Florida specimens just received from Miss Reynolds, of Florida, the outer lip is the larger, or the one which principally protects the gland. How is it in the northern plant? It has long since been announced by me in Am. Jour. Sci., that *Orchis rotundifolia*, Pursh, is a true Orchis.—A. GRAY.

PLATANTHERA BRACTEATA, Torr.—This is usually regarded as a summer flowering species. In my garden, where it has bloomed for the first time this season, it is the earliest of many that I have. The first flowers were open on the 26th of April, and half of the spike had opened by the 1st of May. Hitherto *Orchis spectabilis* has been the

first to open in my gardens, but this season *Cypripedium parviflorum* will beat it. This will be open by the middle of May. My *Platanthera* was originally from Massachusetts, and being from a more northern region, required, perhaps, less heat to advance it than the same species from locations nearer home.

Mr. Wheeler, of Berlin, Mass., finds it in bloom the last week in June at Winchester, N. H., at an altitude of 1,000 feet; so that the time given in the books (July and August), even in its average locations, is probably much too late.—T. MEEHAN, *Germantown, Phil.*

DOUBLE THALICTRUM ANEMONOIDES.—Double Thalictrums are occasionally found, as many instances are on record in the literature of the past one hundred years. Those which I have seen have been white, and, as the florists would say, rather semi-double than double. I have one now in flower sent me last year by Mr Dory, of Springfield, Ohio, that is as double as it is possible to be, and of a pretty, rosy tint of white. The petals are as regularly arranged as in a first-class double Camellia. The object of this note is to encourage observers still to look for double ones; as although double ones are now not novelties, there may be novel shades of color.—T. M.

COBÆA SCANDENS.—It may be worth noting that the flowers of *Cobæa scandens*, the familiar hot-house climber, are distinctly *proterandrous*. At the time that the stamens are shedding their pollen, the trifid stigma is completely closed, nor does it open until the anthers have become functionless.—W. W. BAILEY.

NOTES ON CERTAIN SILKWEEDS.—Of the rare *Asclepias Meadii* Torr., which does not appear to have been previously detected but in Illinois and Iowa, the present writer found two nice specimens near Lancaster, Wisconsin, in flower on the 19th of June, 1879. The species differs notably from *A. obtusifolia*, Mich., with which it is grouped, in that the umbel is nodding by an abrupt bend in the upper part of the peduncle. This character is easily effaced in the process of removing the wilted specimen from damp to dry papers, and so the dry specimens may not have shown it.

The habitat of *A. Sullivantii*, Engelm., according to Dr. Gray, in the Synoptical Flor., is, "from Ohio to Kansas." But upon the wet prairies of central Minnesota it is by far more common than in any locality further north. The far western *A. speciosa*, Torr., has not been reported from farther east than Nevada, but it is frequent in the central part of Minnesota, where the eastern *A. Cornuti*, Decaisne, seems to reach its western limit. To these observations upon known species may be appended the following description of a new one:

ASCLEPIAS UNCIALIS. Stems several, only an inch or two long, decumbent; leaves from ovate to narrowly lanceolate, short-petioled or sessile, smooth and somewhat glaucous, the margins white tomentose; umbels three or four flowered, sessile; corolla dull purple; hoods broadly ovate, truncate, a little shorter than the anthers, their dimpled auricles produced into acuminate points which rest against the anthers

and nearly equal them; the broad, short, thick though somewhat flattened process representing the horn, very obtuse, or sometimes even retuse at the apex; follicles not seen.

Open hill-tops in south-western New Mexico, about Silver City, flowering in April.

In Dr. Gray's arrangement of the genus in the Syn. Fl. N. Am., this species would come next after *A brachystephana*, Engelm.—EDWARD LEE GREENE.

NOTES FROM FLORIDA.—During a recent visit to Apalachicola, I had the pleasure of rambling for several miles in the vicinity of that ancient town in company with Dr. Chapman, and of being introduced by him to many plants peculiar to this region, first discovered and named by him. Of these, none interested me more than the three Myricaceae which I had not before seen; namely, the willow-like *Leitneria*, the *Myrica cerifera*, var. *intermedia*, which is much more distinct than I supposed, and the *Myrica inodora*. The latter I beheld with less pleasure than mortification, for with it I discovered a mistake in my recently issued Third Fascicle. What I distributed under that name is probably *Myrsine Floridana*. The characters presented by the shrub as found in fruit corresponded so well with those of *Myrica* that I too precipitately named it *Myrica inodora*. The latter, however is quite distinct. Dr. Chapman compared the inflorescence of *Myrsine* to a growth of *Cuscuta compacta*

Most of Dr. Chapman's field work has been done in the neighborhood of the Apalachicola river, a region which embraces wonderfully varied and interesting vegetation. Fortunately the most interesting plants were in bloom at the time of my visit, and I succeeded in preparing fine sets of over thirty species for my fourth Fascicle, including three for my second set of Ferns.

No botanist who travels southward should fail to visit the Apalachicola river. Coming here about the first of April he will find the noble *Torreya* in bloom and beneath it the *Croomia*, which at first I confounded with the young plants of *Dioscorea* and *Smilax herbacea* growing with it. Of the shrubs he will hardly know which to admire most, the yellow variety of *Azalea nudiflora*, the red *Æsculus Pavia*, or the white *Chionanthus*. He will be charmed with the *Silene Drummondii*, and stand with awe before the giant cypresses, gums and cotton woods of the river bottoms. He will be tempted to recline on deep cushions of feathery *Selaginella*, and learn to shrink from that vegetable porcupine, the *Chamaerops Hystrix*. He will marvel at the parrot-beaked *Sarracenia*, and feel repaid for his journey if he sees nothing but the wonderful *Sarracenia Drummondii*.—A. H. CURTISS, *Key West, Fla.*

DOUBLE-STAINING OF VEGETABLE TISSUES.—Having used a number of dyes in double staining vegetable tissues, the conclusion I have arrived at is, that no rules can be given which will ensure success in every case. The process is quite familiar to every working micro-

scopist, but I have been somewhat surprised at the limited number who have fairly succeeded in differentiating the tissues.

In my own experience, I have met with some sections which obstinately refused to act as they should, under the operation of the two colors, but even these, with patient manipulation, can be induced to show some results, even though they may not exhibit that sharpness and purity which it is the aim and object of the mounter to obtain.

I think that a writer in *Science Gossip* has come nearer to the true laws governing the process, than any one who has written on the subject; he has, at least, indicated the direction in which the practical worker must look to attain success. My own theory differs slightly from his, and consequently my process varies somewhat, but in the main it is the same.

It seems to me that the capacity for staining tissues resides more in the colors than in the tissue itself. A stain may be permanent, unless it is driven out It may be driven out by some solvent, by some bleaching process, or lastly by some other color. Some tissues hold the stain more tenaciously than others, probably on account of their varying density. Thus the spiral and bass-cells will retain a color longer under the influence of a solvent, than the softer and more open parenchymal cells. I endeavor to take advantage of this property, by giving the whole tissue all of one color that it can be induced to take, and then driving it out of the parenchymal tissue by a stronger color, stopping the process at the moment when the second color has completely replaced the first color in the soft tissues, and before it has begun to act upon the more dense cells. If a section be stained with roseine, and then be left long enough in a solution of Nicholson's blue, the whole section will be blue, with no visible trace of red. If it be taken out before the blue has permeated the entire tissue, the red will show, in some parts, quite clear and well-defined among the surrounding blue tissues. Following out this principle, that exact point must be determined when the blue has gone far enough.

In practice I carry out my theory as follows: I use a two-grain, neutral solution of eosin, and in this I preserve my prepared sections until I am ready to use them. They keep perfectly well in this solution, and are always ready to undergo the final process, which requires but a very short time before they can be placed, fully finished, under the covering glass. After taking them from the eosin solution, I pass them through 95 per cent alcohol, merely to wash off the superfluous color, and then place them in a half-grain solution of Nicholson's blue, made neutral. The time required in the blue solution varies with different tissues, and in the nice adjustment of this time, lies the whole success of the operation. I generally spoil three or four sections of each kind in determining the exact time required. I take a section from the eosin, holding it lightly in a pair of forceps, rinse it off rapidly in alcohol, and then immerse it in the blue, still in the forceps, while I count, "with moderate haste," ten. Then quickly place it in clean alcohol, and brush lightly with camel's hair brush. The immersion in clean alcohol seems to check the operation of the blue in-

stantly. I then examine it under a one-inch objective, to determine whether the exact point where the blue and the red remain distinct has been reached. If the blue has not occupied all the softer cells, I take another section, and put it through the same process, counting twelve, and so on, until the proper point is reached; or on the other hand, decreasing the count, if the blue has infringed upon the red in the more dense tissue. Having thus determined the count for the sections of that particular material, I pass the remainder of my sections through the blue into the alcohol, merely counting off the immersion of each section. I then place the sections for a few moments in absolute alcohol, which seems to fix the colors, then through oil of cloves into benzole, and mount in damar and benzole. It is sometimes advisable, with delicate tissues, to merely rinse off the blue in 95 per cent. alcohol and fix the colors in absolute alcohol, but every operator will learn the minor details for himself in the manipulation.

Of course, with the "rule of thumb" method of counting off the time, slight variations will occur, which will mar the beauty of the finished product; besides which minute differences in the thickness of the section will affect the result, and even a distance of a quarter of an inch in the same stem will make a difference in the density of the tissue, which will be obvious in the sharpness of the colors under the objective. So that the operator should not be disappointed if, out of a dozen slides, only four should be worth preserving. The others can go into the borax pot to be cleaned for another operation. However, the beauty of those which do pass inspection, will amply repay for the labor on the spoiled ones. I have perhaps been needlessly minute in the description of the process I have employed, but I have been so often hampered for the lack of minuteness in descriptions of processes by others, which I have been endeavoring to carry out, that I deem it better to err upon the safe side, even at the risk of being considered dry or prosy.

One word as to the use of eosin. I was attracted to it by its exquisite purity of color under transmitted light, and its perfect transparency. I found that sections preserved in its solution, always retained their transparency, and did not become clogged or thick with color, so that when taken out after months of immersion, the most dense cells were no deeper in color than the solution itself So far as regards its hold upon the tissues, it is as strong as roseine, or any of the heavier colors I have ever tried. I cannot testify as to its permanence, but I have some slides that were prepared over a year ago, that appear to be as bright and pure, as when they were mounted. Contrary to the experience of some others, I have not found that the benzole has any bleaching effect, and I have used it with damar, in preference to the usual balsam. Slides prepared with damar, however, should have a thick ring of varnish around them as the damar is brittle, and should not be trusted alone, to hold the covering glass.—W. *in American Microscopical Journal.*

DOES CHLOROPHYLL DECOMPOSE CARBONIC ACID?—The recent memoirs of Pringsheim (Untersuchungen uber das Chlorophyll) sug-

gest very serious doubts as to the correctness of an inference which has crept, without the explicit consent of botanical physiologists, into the position of a fundamental doctrine of biological science. Recent articles and discussions make it desirable to examine critically, the claims which the inference alluded to has on our adhesion.

The inference in question is this, that the substance known as chlorophyll has the property of decomposing carbo nic acid so as to fix the carbon and liberate a portion of the oxygen of that acid, when in the presence of sunlight. Accordingly it has been said that "Chlorophyll is the hand wherewith the organic world lays hold of the carbon of the inorganic world" Vegetable physiologists are, however, careful not to commit themselves to such an assertion with regard to chlorophyll itself. The chlorophyll grains, or corpuscles, are particles of protoplasm impregnated with chlorophyll much in the same way as the blood corpuscles and other tissues of animals, are impregnated with hæmoglobin. It is one thing to attribute the decomposition of carbonic acid to "cells containing chlorophyll" or even to "chlorophyll corpuscles," and another thing to pass from such a wide statement to the definite ascription of the CO_2-decomposing property to the green colored substance chlorophyll.

It is perfectly true that by the method of concomitant variation, we are led to a conclusion favorable to the *importance* of chlorophyll in this function. It is only by plants (or animals) containing chlorophyll, and only in those parts of the plants containing it that CO_2 is decomposed and oxygen liberated. Further, it appears that whenever chlorophyll is present *in a living organism* (even an animal) exposed to sunlight, the decomposition of CO_2 takes place. But while we are there justified in *connecting* chlorophyll with the decomposition in question, any conclusion as to its sole efficiency, and accordingly any notion of a specific chemical activity on its part, is forbidden by two important facts: firstly, that living protoplasm is always present in intimate association with the chlorophyll when the decomposition of CO_2 is effected (forming the bulk of the chlorophyll corpuscle); and secondly, that chlorophyll extracted from the chlorophyll-corpuscle and put to the test *in the absence of protoplasm* has hitherto not been shown to possess the power of the specific decom position sometimes attributed to it.

Very usually blood red and leaf green are placed side by side as complementary, not only in color but also in function, the one active in oxidation and the special property of the animal, the other, active in deoxidation and the special property of the plant. Nevertheless, a most important fact is true of hæmoglobin which we have not ground for asserting with regard to chlorophyll, namely, that it can be extracted from the albuminoid substance with which it is associated, and then, when in a pure crystalline state can be made to exhibit its peculiar property of combining with oxygen, and again liberating that oxygen just as it does in living tissues. On the other hand the peculiar property which has been inferred for chlorophyll, namely, that of seizing the group CO from CO_2 and liberating O under the influence of sunlight, ceases altogether [as far as we know] when chlorophyll is

detached from the living protoplasm of an organism, and no effect of any kind can be produced upon CO_2 by its agency when thus isolated.

It may be urged that the chlorophyll when extracted from the chlorophyll-grain is chemically altered by the solvent (alcohol or ether) used. But the solution obtained by appropriate treatment of green leaves gives precisely the same absorption-bands as does the green substance in the plant (the whole series being moved a very little to the blue end according to the known law that absorption bands travel in that direction when a less dense solvent is substituted for a more dense one).

It cannot, however, be stated that a negative has been directly proved with regard to the supposed CO_2-decomposing property of chlorophyll. It is possible that chlorophyll when extracted by solvents from the chlorophyll corpuscles may yet be shown to possess that property. The solvents themselves may, so long as they are present, exert an inhibitory effect. Whilst ether and alcohol may do so, it is possible that vegetable fats may be more propitious, or that some other solvents may be found more closely resembling the natural solvent or the chlorophyll-corpuscle than those at present known.

Apart from the absence of sufficient evidence to warrant the assumption that chlorophyll has a specific chemical action on carbonic acid in the presence of sunlight, three facts render the supposition improbable :

1. If chlorophyll were the active agent in CO_2-decomposition, we should expect the rays absorbed by chlorophyll to be those most efficient in promoting such decomposition. Such, it has been shown by Sachs and others, is *not* the case.

2 It may well be that chlorophyll has other work to do in its relation to the specific chemical activities promoted in protoplasm by the incidence of the luminous rays. Prof. Pringsheim suggests that the true function of chlorophyll is by its general absorbent action on light to protect the protoplasm of the cell from excessive oxidation, and especially to protect that of the chlorophyll corpuscles. Oxidation being thus nearly or entirely arrested in these corpuscles, whilst proceeding in a lessened degree in the general protoplasm of the cell, the protoplasm of the chlorophyll corpuscles is at liberty *under the influence of those rays of light which are allowed to pass by the chlorophyll* (the very reverse of former suppositions on the subject) to decompose CO_2 and synthesize the elements of starch (or of hypochlorin).

3. That so special an activity as the decomposition of CO_2 and the synthesis of the elements of starch is due to protoplasm and not to the chemically simple (comparatively) chlorophyll is probable on *a priori* grounds.

If this green pigment is really something more than a screen for protoplasm, its character must be established by direct demonstration of its capabilities. The facts, as at present in evidence, look very much as though chlorophyll had been assigned a position of unmerited dignity.—E. RAY LANKESTER, F.R.S. *in Nature*, April 15.

SOME BIG TREES OF INDIANA.—In Case's *Botanical Index* for

April we find the following record of some large trees growing in Indiana:

Chestnut.—In Jackson county are to be found the largest chestnut trees in the State. They are veritable giants, located about three miles southeast of Seymour. One of these measures 22 feet in circumference, two feet above the ground. The height to the first limb is about 70 feet.

Sassafras.—The Sassafras attains a remarkable size on the Lower Wabash One of of these, one mile and a half west of Springfield, the old county seat of Posey, is full three feet in diameter, and for more than 60 feet, clear of limbs and knots. Its height, in full, is 85 feet.

Catalpa.—In this same region and along the Wabash, the Catalpa grows tall and slender, and in great abundance. It is used for both fence rails and posts, especially for the latter, and for durability stands next to black locust.

Sycamore.—The giant tree of Indiana, in all probability, is a Sycamore in the White river bottom, not far from Worthington. It is said to be 48 feet in circumference, and has a solid trunk. At a height of 25 feet it branches into three or four limbs, one of which must be more than five feet in diameter. The tree is not quite round, but is still quite regular.

A NATURAL BOTANIC GARDEN.—I do not believe that any college grounds in the country, of equal extent, can surpass those of Wabash College, Indiana, in the display of native plants. A large class began active operations in the botanical laboratory as soon as the first flowers came. They have worked unremittingly ever since, some of them several hours a day; but the grounds are far from being exhausted, even of the simpler phænogamous plants. The plants are well distributed through the families and we need no better garden for our work than the one growing without care under our feet. All the Hydrophyllums are there, and Phacelias, Scilla, three or four Trilliums, five or six species of Ranunculus, several Violets, Geraniums, Erythroniums, Isopyrum, Stylophorum, the early Composites, and so on till we could make a very respectable list of spring flowers.—J. M. C.

SOME PLANTS OF FRANKLIN CO., KY.—*Ptelea trifoliata*, L., is rare, but one specimen having been seen *Rhamnus lanceolatus*, Pursh, is common along the limestone cliffs. *Polygala Senega*, L., var. *latifolia*, T. & G., is the only representative of this genus which I have met with, and it is common.

Medicago lupulina, L., is well established in many places along road sides.

Vicia Caroliniana, Walt., was met with only once in rich limestone soil.

Phaseolus diversifolius, Pers., is rare on dry hillsides.

Desmanthus brachylobus, Benth., was only found growing in cultivated grounds. Two species of *Spiræa* were met with, viz: *S.*

opulifolia, L., and *S. Aruncus*, L., both quite plentiful on the river cliffs.

A small patch of *Epilobium palustre*, L., var. *lineare*, was found on the banks of the Kentucky River. *Opuntia Rafinesquii*, Engelm., grows quite abundantly on some dry hillsides. *Passiflora lutea*, L., and *P. incarnata*, L., are both found, the latter rare. *Polytænia Nuttallii*, DC., is not uncommon on rich hillsides. *Conioselinum Canadense*, T. & G., *Thaspium barbinode*, Nutt., *T. trifoliatum*, var. *atropurpureum*, T. & G., *Zizia integerrima*, DC., *Bupleurum rotundifolium*, L., *Osmorrhiza brevistylis*, DC., and *Erigenia bulbosa* are all found along the base of the cliffs in shaded situations—the latter two rare.

Symphoricarpus vulgaris, Mx., bids fair to become a troublesome shrub in pasture lands. *Lonicera flava*, Sim, is not uncommon on the cliffs of Kentucky River.

Valeriana pauciflora, Mx., is found sparingly in rich soils along the base of the cliffs.

Dipsacus sylvestris, Mill., grows along every roadside, and is becoming a troublesome weed.

Eupatorium incarnatum, Walt., (not noted by Gray this far north) grows quite plentifully on the rich Kentucky River hillsides. The flowers have the delightful odor of the cultivated Heliotrope.

Conoclinium cœlestinum, DC., is abundant in damp places. I notice that it produces subterranean runners; that the peduncles have several scattered awl shaped bracts and that the stem is minutely rosy-hued.

Aster macrophyllus, L., *A. simplex*, *Willd.*, *A. tenuifolius*, L., and *A. Novæ-Angliæ*, L., are only sparingly found.

Bellis integrifolia, Mx., is quite abundant on damp, shady hillsides. In similar situations are found *Polymnia Canadensis*, L., and *P. Uvedalia*.

Dodecatheon Meadia, L., is abundant, but I have only seen one plant with rose-colored corollas, pure white being the usual color seen here. *Bignonia capreolata*, L., is plentiful on the cliffs, but I have never found it in flower or fruit. It retains its leaves all winter, though they change to a dull reddish color. *Conopholis Americana*, Wallroth, I found but once, and then growing certainly on *Beech* roots.—R. H. WILDBERGER, *Kentucky Mil. Inst.*, *Farmdale*, *Ky.*

NOTES FROM ILLINOIS.—Mr. H. L. Boltwood reports finding in the neighborhood of Ottawa, *Myosurus minimus*, *Anemone Caroliniana*, *Phlox bifida* and *Astragalus Plattensis*, var. *Missouriensis*.

THE ACORNS AND THEIR GERMINATION.—This is the title of a paper published by Dr. Engelmann in the Transactions of the Academy of Science of St. Louis. The author was induced to pay special attention to the subject by learning that the germinating live-oak developed little tubers, well known to the negro children and greedily eaten by them. In this paper he gives the results of his study of the

acorns and oak seedlings, not only of the the live-oak but of many other species. We give the following synopsis:

In the tip of each acorn we distinguish, imbedded between the two large fleshy cotyledons, first, the little caulicle, and then at its upper end (towards the centre of the acorn) the two stalks or petioles of these cotyledons; between these the plumule is visible, more or less developed, usually only a truncate or slightly notched or emarginate knob. These parts together are in the different species and in different sized acorns usually from one to three lines long and one-half to one line in diameter; in very small acorns sometimes smaller

The acorns of all oaks germinate in or on the ground, the thickened stalks and the caulicle elongate; the former become 2 to 4 or nearly as much as 6 lines long, while the cotyledons themselves remain enclosed in the cracked seedshell, and from between the bases of the stalks the plumule grows up into the ascending axis, nourished by the food contained in the cotyledons; these become exhausted and rot away about the end of the first season, while the radicle about the same time swells up, evidently absorbing part of the matter contained in them and thus laying up a store of food for the next season.

The process in *Q. virens* is essentially the same; it differs somewhat in that the connate stalk of the cotyledons remains more slender, but elongates more, mostly to the extent of one inch or even more; the caulicle and upper part of the root swells up at once, while the developing plumule forces its way up through a slit in the base of the stalk. It seems that the danger of losing connection with the storehouse of the cotyledonous mass through the long and slender passage of the stalk, necessitates the transfer of the food-matter to a nearer and safer place of deposit. But why, it may be asked, is the connection so much longer and more slender than in other oaks? At all events it suffices, as long as it is fresh and unimpaired, to carry over in a very short time the starchy and sweet contents from the cotyledons to the tuber; and before the ascending axis is an inch high and bears as yet only a few minute bracts, the tuber is already forming and it soon reaches the size of the cotyledons themselves; it is, however, longer and more slender, of a fusiform shape, about three to four lines thick and one to two inches long, attenuated below into the long tap root.

The whole process is similar to the germination of the cucurbitaceous *Megarrhiza* of California, so beautifully illustrated by Gray in his Structural Botany; with this difference, that the cotyledons in that plant are raised above the ground, while in ours they remain hypogæous, and that the stalk is even longer, and is, together with the cotyledons, readily separable into its two component parts. In both plants a tuber forms at once by the transfer of the food-matter from the cotyledons to the radicle; in the herbaceous *Megarrhiza* the tuber becomes a permanent organ of immense size, while in the arboreous live oak it is finally merged in the root.